Annual Report

Enhancement of Daily Raingauge Network in Mexico in Support of NAME

Annual Report 2005

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PROJECT DURATION
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1.0 INTRODUCTION

This report summarizes progress on the installation of a simple raingauge network in NW México during the period October 2004 – September 2005. Activities were focused in three general areas: (i) implementing an enhanced network of simple raingauges in Northwest and Northcentral Mexico, (ii) establishing data collection procedures, and (iii) developing a project Web page for data upload and dissemination. Some specific activities during FY 2005 included network installation, data transmission and reporting, digitizing data, performing preliminary quality control and producing daily rainfall maps.

2.0 ACCOMPLISHMENTS

The following is a summary of accomplishments during the period October 2004 – September 2005.

(i) Network Installation

As of now there are 405 gauges installed in the State of Sonora and 115 gauges installed in the State of Chihuahua that are directly supported by this activity. The installation in the State of Sonora is complete but funding delays (documented in last years annual report and in this years annual report) delayed our installation of the network in Chihuahua and other states.

The Civil Protection Office of the State of Sonora (CP-Son) has offered their communications network in order to make daily reports to headquarters in the State Capital, Hermosillo. As a consequence, the data in Sonora is reported in real-time. During FY05 the Ranchers Association of Sonora joined our effort and an additional 105 raingauges were installed.

To date we have installed 115 gauges in the State of Chihuahua. The infrastructure in Chihuahua is more limiting (e.g. the Civil Protection Office does not have a good communication system to cover the entire state). Since FY05 funds were delayed by 6 months, our efforts to install the remaining gauges (totaling 400) were delayed to the fall of 2005 (after the end of the monsoon season). Figure 1 shows an example of a recent installation in one of the ranchos we visited in Chihuauhua.

Figure 1.- Raingauge installed at “El Vivoreo Ranch”

When installing the raingauges we relied on local residents to help us identify the infrastructure (roads, towns, etc.). Some regions of the Sierra Madre Occidental (SMO) are dangerous. When installing the gauges we always had the support of the State Police and Civil Protection Offices. Weather was a major factor at times (e.g. high temperatures occasionally in the 43-48 ^{0}C range).

(ii) Current Data Base

Daily reports for the 2005 monsoon season from the networks in Sonora and Chihuahua have been collected with a high efficiency rate (roughly 95% for the State of Sonora) and incorporated into our Data Base (hereafter DB). Data from the 2004 monsoon season (primarily from the State of Sonora) has been included in the DB. Though parts of the network have been automated, and many volunteers submit their reports via the project Web page, in some cases (e.g. the Civil Protection Office in Hermosillo) the data is radioed or sent via regular mail. This data is being used operationally by the National Water Commission (CNA) through the Mexican Meteorological Service (SMN).

Other networks have been incorporated into our inventory, including the National Water Commission, CNA (134 gauges) and Irrigation Districts (154 gauges). When combined with the gauges installed by this activity, the total number of gauges in our DB is 703 for the State of Sonora and 115 for the State of Chihuahua at the present time. Additional gauges will be installed in the State of Chihuahua starting in late October 2005.

The DB is accessible through a project Web Page (http://galileo.imta.mx/DBNAME/pagina.php) and both digital and graphical displays are available.

More details about the DB design and implementation, a major focus in FY05, appear below.

(iii) Data Base Design and Implementation

The DB was implemented using public domain software (http://www.mysql.com/why-mysql) and a dedicated server The DB was designed to store rainfall data on the day it is reported (current day), but it also has the capability to store rainfall data from previous days. Daily accumulations are from 12Z-12Z.

Tables have been developed for the States of Sonora, Chihuahua, Baja California, Baja California Sur, Sinaloa, Durango and Morelos. Table 1 shows the structure of the data.

TABLE STRUCTURE WITH THE NAME OF THE STATES		
FIELD NAME	DATA TYPE	DESCRIPTION
Consecutive_No	Integer	Field used as a primary ID
Station_Id	Character	Stores station's key ID
Latitude	Double	Latitude of station
Longitude	Double	Longitude of station
Elevation	Integer	Station elevation
Station_Name	Character	Name of station
Municipality	Character	Municipality or County where rainaguge is installed
Basin	Character	Name of the respective basin
State	Character	State's Name
Resp_Name	Character	Name of volunteer or responsible for the station
Address	Text	Volunteers or responsible's address
Telephone	Integer	Telephone (if available) of volunteers where he/she can be reached
Comments	Text	Comments about the station, for future visits to the sites
Picture	Character	Usually a photograph is taken to volunteers or locations where raingauge is installed

Table 1.- Table structure to identify general station identification

Besides the tables used to identify stations, there are others used to store the rainfall data (e.g. Table 2).

TABLE STRUCTURE (datos_lluvia)		
FIELD'S NAME	DATA TYPE	DESCRIPTION
Station_ID	Character	Station's ID
Rain	Float	Rainfall data
Temperature	Float	Temperature data (reserved field)
Date	Date	Date of corresponding rainfall data

Table 2.- Table structure for rainfall data

Each table is linked via the common variable Sation_ID.

(iv) Web Page Design

Access to our DB via a project WEB page has worked very well for data retrieval. In this way every volunteer has access to the DB in order to make the daily reports and to use data from the network as a whole. In the case that a volunteer has more than one station to report, the WEB page allows one to store the data with minimum effort.

The URL site for the WEB page is: http://galileo.imta.mx/DBNAME/pagina.php

The concept of having an active and dynamic WEB page allows us to modify the design and satisfy volunteer and user requests. The WEB page has several features: 1) Data consult; 2) Data capture; 3) Documentation; 4) FAQ's; 5) Related Links; 6) Who we are? and 7) Administration.

1) **Data Consult**
   This option allows a user to consult data in different formats and displays. Rainfall data can be downloaded in ASCII format ready for an Excel spreadsheet. The user can specify the period to download. There are 2 graphical displays: (a) daily spatial distribution (Figure 2) and (b) time series.

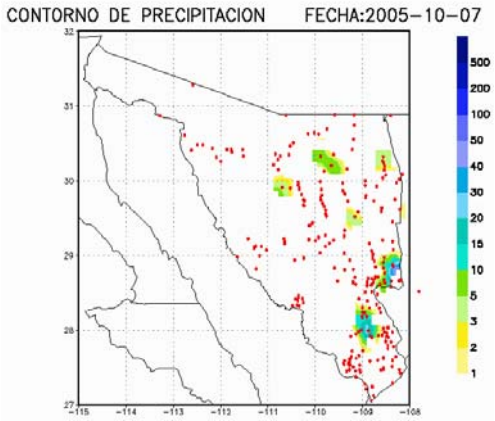

Figure 2.- Spatial representation of the 24 hour cumulative rainfall for a specific day (October 7th, 2005).

Time series show cumulative rainfall for each station. Figure 3 shows the base map for the State of Sonora. Users click on any municipality (e.g. Figure 4, shows that for the Municipality of Rosario where 17 raingauges were installed) and then click on any of the points to display time series of rainfall for the last 31 days (Figure 5).

Figure 3.- Base map for the state of Sonora, in the WEB page the user can click on any municipality and will see the raingauge estations who are installed in that region.

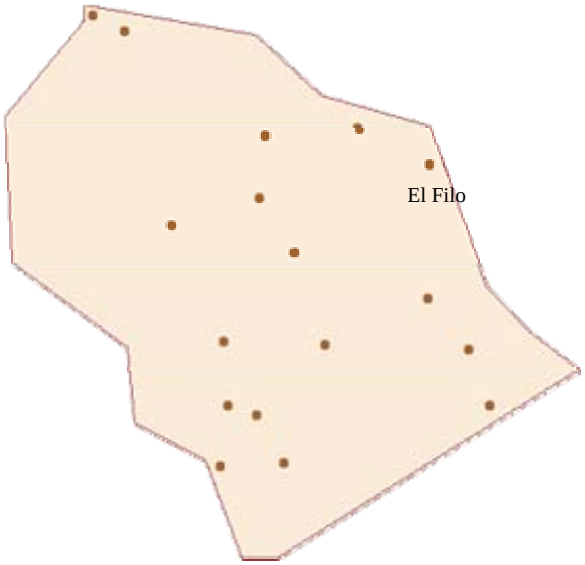

Figure 4.- Municipality of Rosario, holding 17 raingauges which trough the Web page can be obtained the graphical history of the last 31 days.

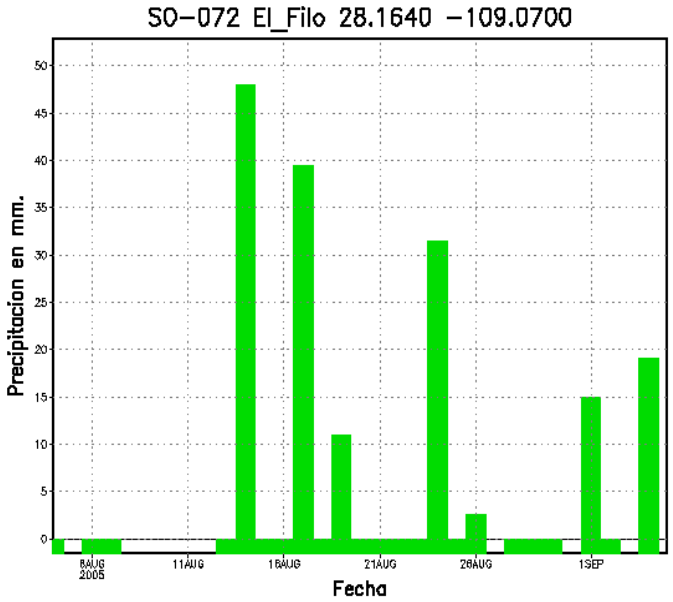

Figure 5.- Time series of daily cumulative rainfall for the location of El Filo, the series holds the last 31 days, every day a data is reported, the last value is replaced.

2) Data Capture

The second option from the left on the WEB page covers data collection into the DB. There are two ways to feed data depending on the number of stations to report. For a volunteer who has a single station to report, a login and a password is given from the administrator's system. In this way the volunteer can only have access to a unique site. Volunteers with multiple sites have a login and password that goes directly to the stations under his/her supervision.

3) Documentation

The WEB page has all related documentation: An installation manual; data sheets; annual reports; status of the network installation, etc.

4) Data distribution

Because the DB was released in 2005, rainfall data collected in the previous year was loaded during July 2005. The DB has been distributed to established data distribution centers (e.g. SMN) and sent to CPC for further analysis. We are currently developing the capability to make the data available on an anonymous *ftp* site at IMTA (ftp.imta.mx) for use in daily analysis products (e.g. at CPC) and other applications.

3.0 ONGOING AND FUTURE WORK

During FY06 we plan the following:

a) Translation of the WEB page into English;
b) Install the remaining gauges during the autumn of 2005;
c) Plan the transfer of the network authority to the SMN;
d) Continue data collection;
e) Improve quality control procedures and dissemination via the Web page;
f) Incorporate the DB into the CPC Unified Raingauge Data Base and analyze.

4.0 CONCLUSIONS

We made considerable progress on the simple raingauge network in FY05 despite substantial funding delays. The general public has consistently and enthusiastically supported this effort. Limited infrastructure in several States (e.g. Chihuauha) continues to be a considerable challenge. However, the success of the network is not just due to participants from NOAA, IMTA, and other institutions. Rather, it is the volunteers that make this possible, since they are the ones who seem to feel most directly the utility of the information collected. We have many comments from them describing the benefits for their region. And they welcome the opportunity to be specific and objective in helping us to record data that will contribute to operational monitoring and forecasting and improve understanding of the North American Monsoon.